WAREHOUSE LAYOUT DESIGN USING SHARED STORAGE METHOD

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ABSTRACT

The aim of this study is to provide a storage rack layout of raw materials for the new warehouse in accordance with the needs of storage space and material handling also more effective space usage. The minimize handling displacement distance of material that have the highest frequency of movement approach is used in this study. The result on the layout of the proposed generating material handling mileage for new warehouse is 8007 m. While the layout of the initial mileage amounted to 13.363 m.
Key words: Shared Storage, Order Picking, Warehouse Design

1. INTRODUCTION

Competition between companies increasingly high, the company is required to have the ability to continue to grow and make changes. Many companies are making changes to the warehousing system to make it more effective, efficient, and avoid wastage. Warehouse has an important function in maintaining the smooth production in a company (Wingjosoebroto, 2009). The one of warehouse function is to protect the raw materials or finished goods from damage.

Effective and efficient warehousing able to adapt to the demands of the increasing speed of the process from receipt, storage to delivery. Good warehousing system is warehousing system that can effectively utilize space in order to increase the utility of space and minimize the cost of material handling (Heragu, 1997).

The fast moving consumer goods (FMCG) industry has chosen as case study which produce infant care needs. Annually by 6% of companies have growth in new products. In the storage of such products, The company has two types of warehouse, warehouse of raw materials and finished goods warehouse. On the raw material warehouse is a repository of raw materials such as cardboard packaging, labels, stickers, bottle caps and bottles. Because each year the company quality of its products has growth, the investigation of the product will increase as well, one of them on the spot storage. The conditions of storage today is the most require attention activity.

The accumulation of goods that result in excess capacity (overload) in addition to the shelf of the warehouse or the hall at the warehouse did not take advantage of extensive warehouse capacity and warehouse storage. If this condition continues to evolve, the state of the warehouse to store raw materials is disturbed, so that the companies want the addition of a warehouse in the factory area.

2. THEORETICAL BACKGROUND

The layout is an important decision that determines the efficiency of an operation in the long term. The layout is a facility design, analysis, conceptual and manufacture of systems for a good or service.

The main purpose of the layout is the arrangement layout optimization on machines and production equipment so that the layout can optimize production operations (Bisen, Vikram & Srivastava, 2009).

Warehouse is a place that is used for storing goods. In general, the function of the warehouse is a storage place for various kinds of products which have a storage unit in the number of both large and small and in a period when the products are produced by the manufacturer (seller), when the product required by the customer or a work station in production facilities.

Warehouse layout is a design that minimizes the total cost of the search for the best guide to the space and handling of products (Heizer and Render, 2009). The purpose is to minimize warehouse layout optimal point in product handling costs and costs relating to the spacious warehouse space. There are several types of warehouses which are Manufacturing Plant Warehouse, Central Warehouse, Distribution Warehouse, Retailer Warehouse.

There are four main categories in storage in the warehouse, namely Random Storage, Class-Based Storage, Dedicated and Shared Storage Storage (Chan & Chan, 2011). Shared storage is a combination of dedicated storage methods with randomized storage methods where the dedicated storage is the storage of products that are placed on a storage location that is fixed, dedicated storage methods can easily find a product that is stored or retrieved while randomized storage is a method that overcomes the shortcomings of dedicated storage. Shared storage method is one method of storage of products in the warehouse.

Shared storage method apply to one type of product which is not placed in a special place, but in shared place with various other types of products. When the storage rack is empty, it can be used for storage of different products (Bartholdi & Hackman, 2011). In allocating the product, this method does not put the product at random, but rather can be controlled laying of storage. The first incoming goods placed close to the point of input / output (Heragu, 1997).

3. RESEARCH METHOD

The study was conducted with several stages:

1. Classify products based on the main principles, supplies classify inventory based on the current flow of goods (Fast, slow, idle).
2. Need for pallets.
3. Determine the storage capacity.
4. Designing the layout of the storage rack by rack needsstorage and space allowance based shared storage method.
5. Calculate total mileage on the design with rectalinier distance.
6. Make the product placement using shared storage method

3.1. Classification of Products

Flow of the goods in the form of goods classified by outbound activities. Outbond activity are activiies taking raw materials from the warehouse to the warehouse exit. This classification aims to determine the status of the movement of each raw material in the first year and eliminate raw materials that are not required to be stored in the new warehouse. The classification is as follows:

1. Fast Moving = goods to flow very fast, that are in a warehouse in a short time (1 Month / Day 30-31).
2. Slow Moving = goods with the flow is not too fast and not too long, are in a relative longer period of fast moving (15-90 days)
3. Idle Moving = goods with slow flow, so that the slow-moving items that are in the long term (91-360 days).

3.2. Calculation of Pallets

To take into account the needs of data storage required palettes in the number of pieces per pallet. Total storage per year will be divided by a constant divisor
according to the status of raw materials. The constant divider palette aims to determine the capacity needed in the feedstock.

3.3. Determination of storage capacity

Raw materials can be classified based on the current flow of goods out. Classification in the form of fast, slow, idle and obsolete. Analysis to determine the capacity of the warehouse usage which also uses the company's growth as growth in demand and production every year.

3.4. Design The Layout

Design the layout of storage racks and storage rack needs-based allowance based on the method of shared storage roomIn

determining the amount of storage needed, required efficient use of rack by preparing one block consisting of four bin with 6 levels so that the total palette in one block is 24.
The calculations in one storage block is as follows:
storage shelves = (2) Length Pallets x (2) Width palette

4. RESULT AND DISCUSSION

storage shelves = (2) x 1.5m (2) 1.5 m = 9 m^2in one block require extensive 9m^2. After getting space area data in one block, will count the number of blocks of storage required with formulas and calculations as follows:
Storage racks needs:

$$\frac{Total\ Product}{Numer\ of\ Product\ in\ 1\ Pallet} = \frac{1336}{24}$$
$$= 55{,}6 \sim 56\ Rak$$

Space need s for 56 rack storage shelves is: 9 m^2 x 56 = 504 m^2 Rack.

4.1. Determination of Allowance Space

Next step will be calculated utilization of space alley or allowance for moving material handling using a forklift as a means of transport of raw materials in accordance with the size and dimensions forklift. Alley wide Determination for the forklift when carrying raw materials, according to formula and the calculation as follows:

$$Diagonal = \sqrt{(lenght)^2 + (Wide)^2}$$
$$Diagonal = \sqrt{(3)^2 + (1.5)^2} = 3.4\ m^2$$

By knowing the allowance needed so we can determine the wide of the alley is 3.4m^2.

4.2. Creating Layout Design

After calculating the required amount of storage racks and storage area as well as the calculation of allowance, layout design of storage shelves are made. In calculating the amount of the storage rack needs as much as 56 blocks will be collated in various way on area of 504 m^2 and has a alley width of 3.4 m for forklift maneuver.

In design the layout of the storage rack, has three alternatives with different considerations for design:

1. Alternative design does not exceeding capacity building area of new warehouse (52 m x 28 m).
2. Alternative design is made not also exceed the capacity rack storage area needsand space allowance, because the purpose of this study is to make a proposal laying new warehouse shelf in accordance with the needs of storage space and warehouse allowance.

The purpose of this alternative is to determine the layout design appropriate storage shelves and by calculating the total mileage on each block by using rectalinier distance. The distance between the material handling start from the entry door to exit, the distance calculation is done using the method rectalinier distance by measuring the distance along the track by using perpendicular (orthogonal) to one another to the point of each shelf storage by the formula:
dij = | x-a | + | Y-b |
Annotation :
dij = distance to the point ij slot I / O
x = The starting point for the calculation of the I / O on x axis (horizontal)
a = Distance midpoint of interest to the axis x
y = The starting point for the calculation of the I / O on y axis (vertical)
b = Distance middle point of interest on the y-axis

In this study created three alternative storage rack layout design. The third alternative is based on a new warehouse with an area wide enough to meet the needs of 504 m^2 space. comparison of the layout design of storage shelves along with the total mileage using distance rectalinier.

4.3. Layout Storage Rack

Laying the storage rack simple as this is famous due to material handling transporters require forklift. after taking a forklift pallet must rotate in one direction. Activity like this is very difficult for the forklift operator to

rotate his forklift. But the shared storage method is very supportive material handling activities carried on by the operator because after placing the raw materials are sorted Based on current flows of goods, operators no longer need to drive around looking for raw materials are often used, simply by looking at the front of the storage area. Total mileage is generated is 1918m on both mileage namely inbound and outbound. Figure 1 is an alternative one to design the layout of the storage shelves.

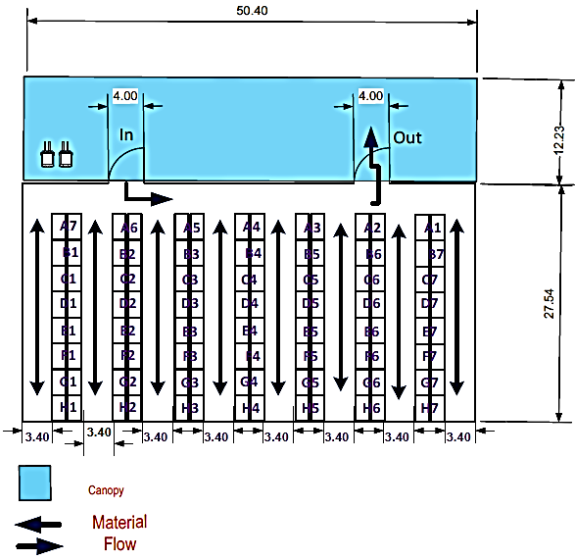

Figure 1. 1st Alternative Layout

4.4. Layout Storage Rack (back and forth flow)

Laying of storage shelves on the 2nd alternative is not much different from the first alternative. Only in this 2nd alternative, Doors inbound and outbound are at the same point and the calculation starts from the shelves near the door inbound and outbound. For analysis of the storage rack is the same as the alternative 1st but alternative 2nd more difficult for the operator to perform pickup activity because inbound and outbound doors because there is at the same door making it. Alternatives 2nd have a short distance of its total material handling, requiring only the overall distance of 1385m for left and right doors. Figure 2 is a design layout of the storage shelf on the 2nd alternative.

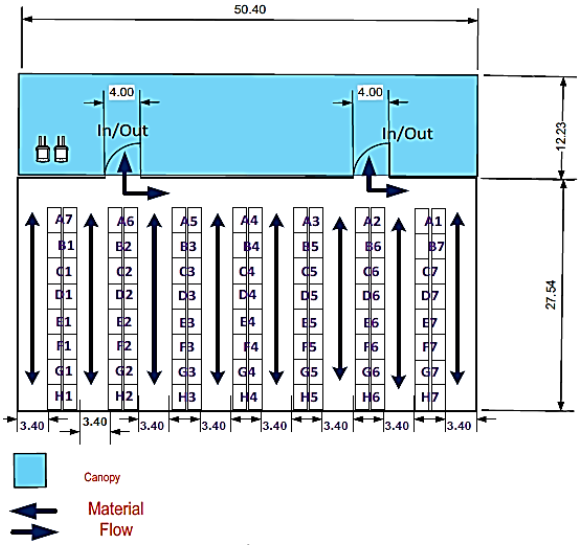

Figure 2. 2nd Alternative Layout

4.5. Layout Storage Rack (Flow U-turn)

Laying the storage racks like this is very good for the smooth retrieval and delivery of goods due to the road directional forklift more directional. Operator is not difficult to make a product decision. but the layout design of storage shelves such as these require very much time and requires the operator to get used to implement the system, that is entered in the door to the right and out the door to the left. Mileage for forklift also very long, 2436 m at a distance of 2268 m on the inbound and outbound distance. Figure 3. is design alternative 3rd.

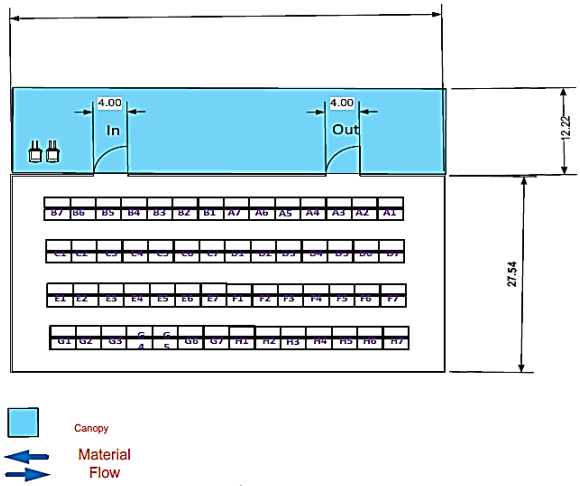

Figure 3. 3rd Alternative Layout

The results obtained that the best layout storage design is alternative 2nd , in a new warehouse that design it has a total distance of material handling 1385 m. Besides having

the shortest distance, Alternatives 2nd has a U-shaped flow pattern, U shape pattern material flow is a pattern that is used when the flow of incoming and outgoing material through the same place.

5. CONCLUSION

The conclusion that can be derived from this study are as follows:

1. Result from calculated data shows that 56 blocks of the storage rack are needed with each block can accommodate 24 pallets and a height of 6 levels
2. Width of the forklift alley obtained from the calculation is 3,4m.

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